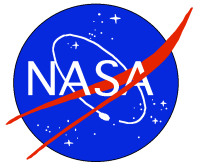




# Section 5.1

**Space Network**

**Ground Network**

**KSC**

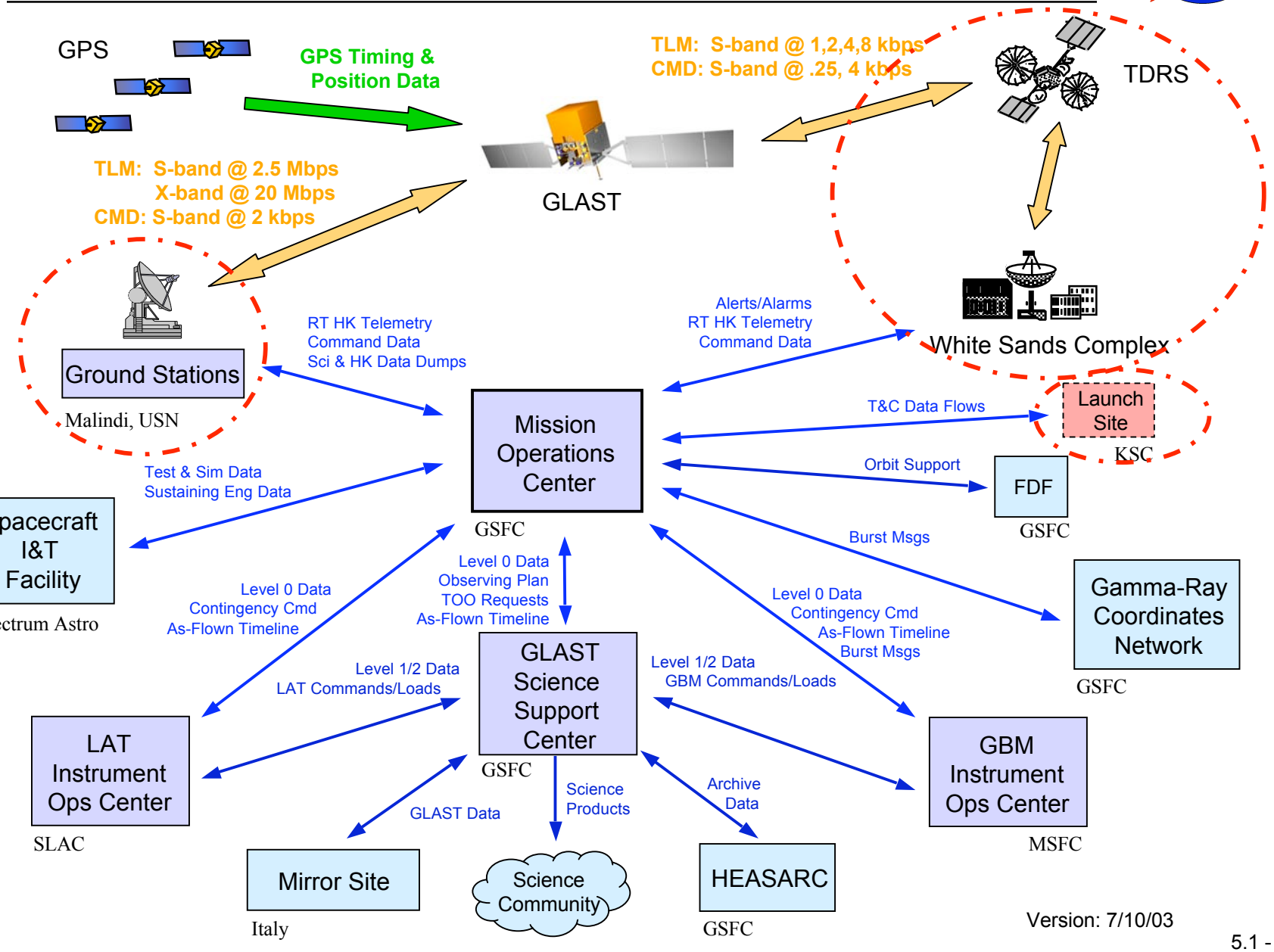
**Ground Comm**

***Ross M. Cox***
*Ground Systems/Operations Engineer*


# Outline

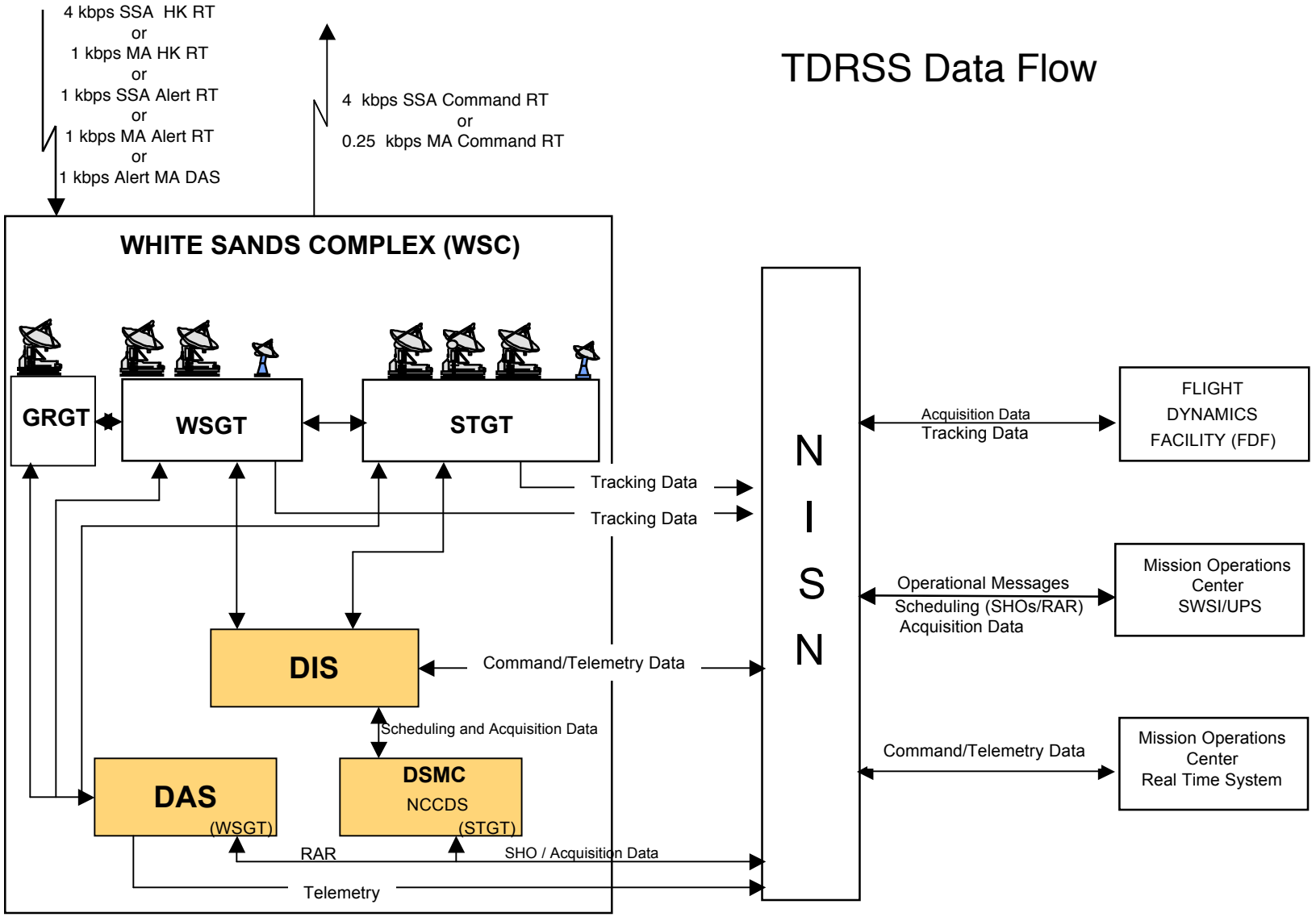
- **Ground System Architecture**
- **SN**
  - *Architecture*
  - *SN Requirements Summary*
  - *SN Existing Vs. New Capabilities*
  - *SN Documentation*
- **GN**
  - *Architecture*
    - *Malindi*
    - *USN*
  - *GN Requirements Summary*
  - *GN Existing Vs New Capabilities*
  - *GN Documentation*
- **KSC**
  - *Requirements Summary*
- **Ground Comm**
  - *Requirements Summary*

# Ground System Architecture




Version: 7/10/03

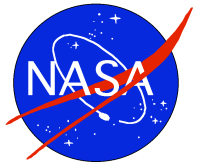
# SN Architecture



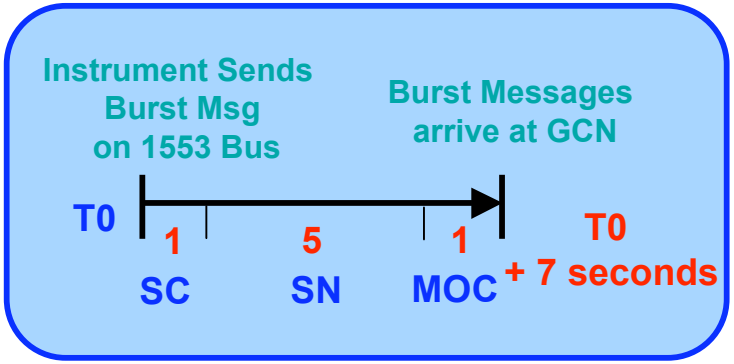

# SN Architecture

- **Link Rates**
  - *Telemetry*
    - *4 kbps SSA return for RT HK and Alerts during contacts*
    - *1kbps MA return for RT HK and Alerts during contacts*
    - *1 kbps MA DAS for Non-contact Alerts*
    - *No Recorder Playbacks*
  - *Command*
    - 4 kbps SSA forward
    - 250 bps MA forward
- **Tracking**
  - *Tracking data by Dual-One Way Difference Doppler (DOWD)*
    - *S/C Transceiver does not support two way ranging*
- **Scheduling Interface**
  - *SN Web Services Interface for DAS and WDISC scheduling*
- **System Features**
  - *Orbit-wide coverage from omni S-band*
    - *Possible loading conflict with other missions (e.g.,ISS)*
    - *GLAST support time requirements are not very stringent*
  - *Support provided as service from NASA*
  - *Operational messages from site during all contacts*


# SN Requirements Summary

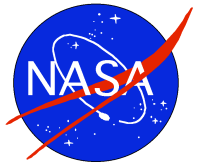



- ***Key SN Requirements***
  - *Provide required MA and SSA services*
  - *Ability to schedule an MAF service within 30 minutes for TOO commanding purposes*
  - *Alert Processing through DAS (24x7) at 1 kbps*
    - *Alerts through system in 7 seconds*

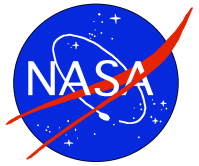



- ***SN Existing Vs New Capabilities***
  - *Implementation of existing services*


# Generic SN ICDs to Missions




- ***DAS to DAS Customers ICD (453-ICD-DAS/Customer)***
  - *Generic existing document applied to all users*
  - *Defines DAS guidelines/expectations*
- ***ICD Between the NCC Data System and MOCs (451-ICD-NCCDS/MOC)***
  - *Generic existing document applied to all users*
  - *Defines NCC guidelines/expectations*


# Section 5.1

**Space Network**

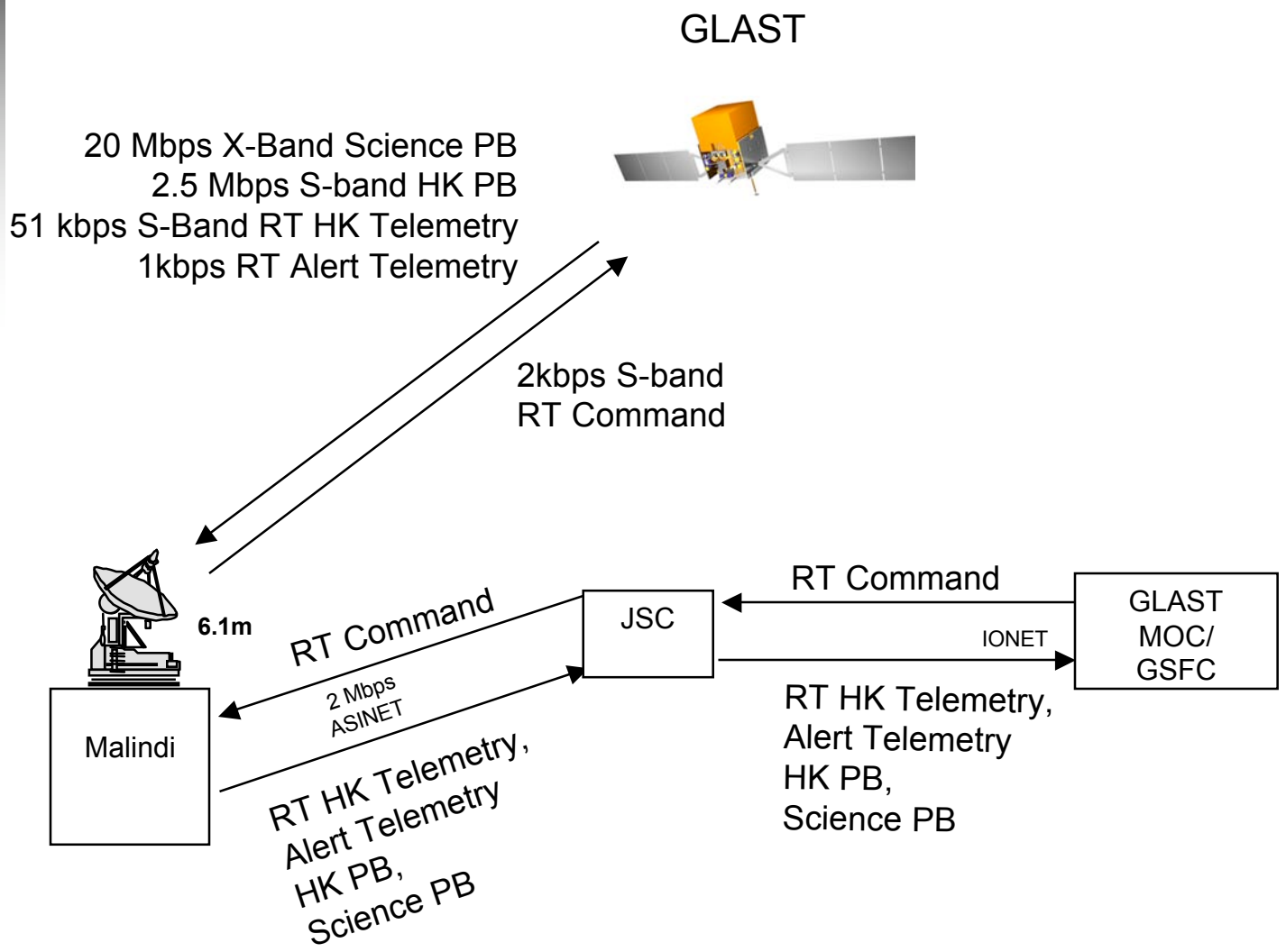
**Ground Network**

**KSC**

**Ground Comm**

***Ross M. Cox***
*Ground Systems/Operations Engineer*

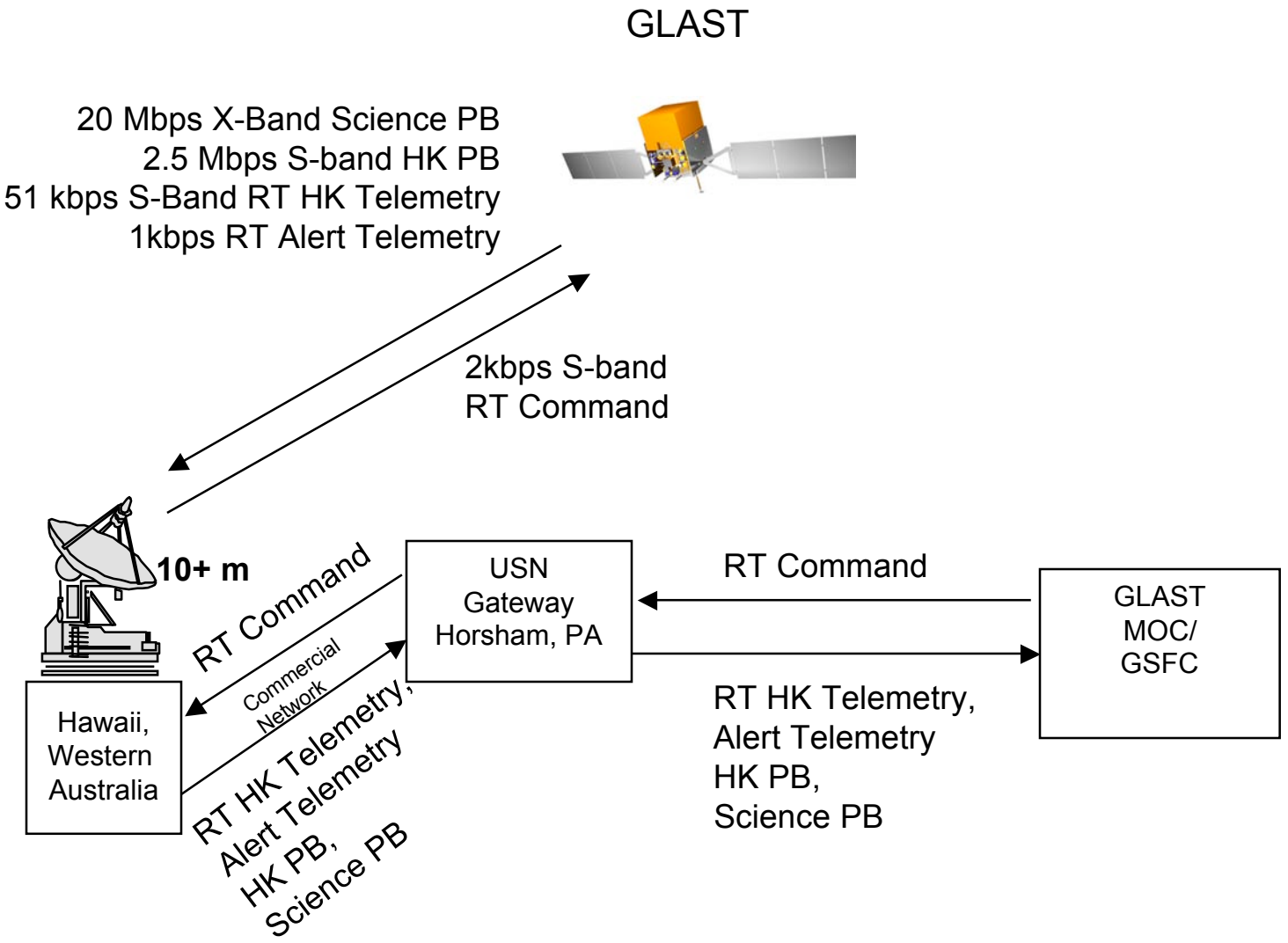
# GN Malindi Architecture




# GN-Malindi Architecture


- ***Link Rates***
  - *Telemetry*
    - 20 Mbps SCI PB
    - 2.5 Mbps HK PB
    - 51 kbps Real Time HK
    - 1 kbps Real Time Alerts
  - *Command*
    - 2 kbps
- **Tracking**
  - No Tracking required
- ***Scheduling Interface***
  - File Based Interface
- ***System Features***
  - *Malindi 6 .1 m antenna*
  - *Link from Malindi to Fuccino is a space hop*
  - *JSC connection between Fuccino and GSFC is located in a secure room*
  - *Possible loading conflict with other missions*
  - *Support is "free" in exchange for ASI Mirror data site*

# GN-USN Architecture

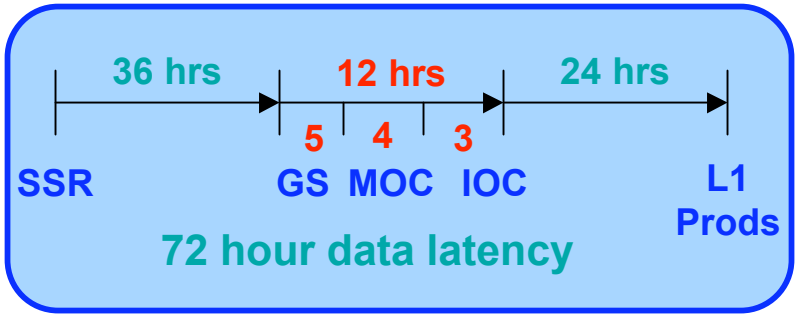


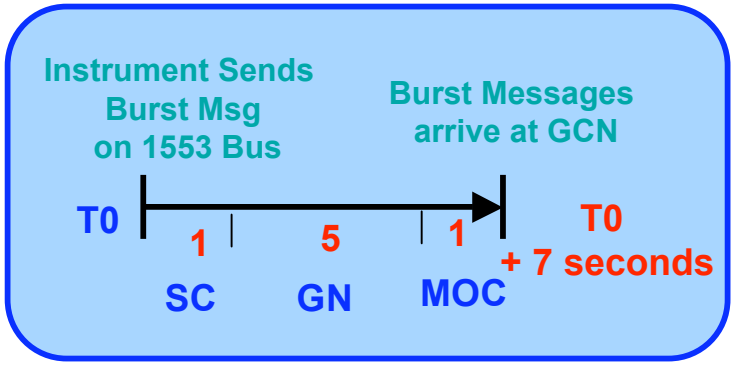

# GN-USN Architecture

- ***Link Rates***
  - *Telemetry*
    - 20 Mbps SCI PB
    - 2.5 Mbps HK PB
    - 51 kbps Real Time HK
    - 1 kbps Real Time Alerts
  - *Command*
    - 2 kbps
- ***Tracking***
  - *No Tracking Required*
- ***Scheduling interface***
  - E-mail Interface
- ***System Features***
  - *Requires two strings of equipment*
  - *Pay per pass support structure*
  - *Good coverage for long duration passes from two stations*
  - *Leverage existing equipment*
  - *Possible loading conflict with other missions*


# GN Requirements Summary


- ***Key GN Requirements***
  - *Provide PB data within 5 hours from sites to MOC 80% of the time*
  - *Processing Alerts as part of real time stream within 0.5 seconds, 95% of the time*
  - *Support Automated MOC for RT and PB data acquisition*
  - *Station call-up with 15 minutes for spacecraft emergencies*
    - *Subject to view constraints*

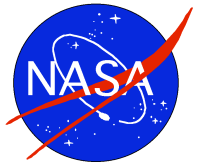



# GN Existing Vs New Capabilities

- **GN - Malindi**
  - *Comparable to SWIFT in S-band support*
  - *Upgrades to be performed by ASI*
    - *20 Mbps equipment for X-band*
    - *Return link to MOC of 2 Mbps*
      - *PB latency is affected*
- **GN - USN**
  - *Existing Commercial Network*
  - *Additional Equipment resources may be required to support simultaneous X-band and S-band*
  - *Will have to purchase high speed lines to meet our latency requirements*


# GN Documentation




- **GN - Malindi**
  - *ASI establishes ICD MOC*
  - *MOC establishes Ops Agreement with ASI*
- **GN – USN**
  - *MOC establishes ICD and Ops Agreement with USN*
- **GN- Spacecraft ICD**
  - *Spectrum establishes this ICD*
  - *It is applicable to both sites*


# Section 5.1

**Space Network**

**Ground Network**

**KSC**

**Ground Comm**

***Ross M. Cox***
*Ground Systems/Operations Engineer*


# KSC Requirements Summary


- ***From ground system perspective, KSC shall***
  - *Provide Voice & Data link connectivity to the MOC*
  - *Provide access to network connectivity between the Observatory and the MOC for the exchange of Telemetry & Command data*
  - *Will Support End-to-End TDRSS test similar to the SWIFT test in Hangar AE*
  - *Provide real time Delta inertial guidance data to FDF*

- ***GLAST GDS will work with KSC to:***
  - *Participate in Launch Simulations*
  - *Attend KSC Meetings (GOWGs, MIWGs, etc)*
  - *Develop  Launch Site Support Plan (or equivalent)*


# Section 5.1

**Space Network**

**Ground Network**

**KSC**

**Ground Comm**

***Ross M. Cox***
*Ground Systems/Operations Engineer*


# Ground Comm Requirements Summary

- **From ground system perspective, the Network shall**
  - *Be NPG 2810.1 Compliant*
  - *Be 99.98% Reliable and Available mission critical circuits*
  - *Provide Voice Comm between elements during Launch and Mission Phases*
    - *Combination of SCAMAs, CCLs and black phones as needed*
  - *Transmit observatory data from the GS to the MOC within 3 hours*
  - *Transmit Burst Alerts from WSC to MOC within 0.5 seconds, 80% of the time*
- **There are no GLAST Ground Comm requirements that require new technology**